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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/986,987	11/13/2001	Takanobu Nishida	900-407	6028

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EXAMINER

OLSEN, ALLAN W

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 03/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/986,987	Applicant(s) NISHIDA, TAKANOBU	
	Examiner Allan Olsen	Art Unit 1763	

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4,8-11,13,14,16-19,22 and 23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4,8-11,13,14,16-19,22 and 23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

Claims 1, 13 and 16-19 are objected to because of the following informalities:

The claims refer to a "change rate" of the dielectric constant. However, the specification, addresses the change in the dielectric constant and not the rate at which the dielectric constant changes.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-4, 8-11, 13, 14, 16-19, 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Kropewnicki in view of U.S Patent 5,453,157 issued to Jeng.

Kropewnicki teaches ashing a layer of photoresist that overlies a low k dielectric. Kropewnicki teaches ashing with an oxygen plasma generated with an RF plasma source providing 100-5000 W of power while the pedestal electrode, upon which the substrate is supported, is RF biased with a power of 75-500 W (see, for example: col. 12, lns 48-52; col. 11, lns 22-25 and col. 10, ln 41). These power limits provide for a source/bias power ratio of as low as 0.2. With respect to the substantially pure oxygen limitation, it is noted that Kropewnicki teaches using oxygen as a cleaning/ashing gas

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and that the addition of an additive is optional (col. 6, Ins 48-65 and column 10, Ins 42-43). As Kropewnicki teaches etching the same material with the same gases and under the same conditions as the claimed invention, the formation of a protective film it is considered an inherent feature of Kropewnicki. Kropewnicki teaches using a temperature controlled pedestal electrode to support the substrate. Kropewnicki teaches a temperature of about 15°C to about 20°C (col 7, In 27).

Kropewnicki does not explicitly teach that the low-k material is not damaged or that the value of the dielectric constant does not change by more than 10 %.

It would have been obvious to one skilled in the art to conduct the method of Kropewnicki in a manner that did not cause the dielectric constant of the low- k material to change by $\geq 10\%$ because Kropewnicki teaches the ashing of photoresist from atop a material having a dielectric constant of less than about 3.2 and more preferably less than about 3.0. As such, the dielectric constant of a material with the preferred dielectric constant of 3.0 cannot change by $\geq 10\%$ because this would result in a dielectric constant that exceeds Kropewnicki's upper limit of 3.2

As noted above, Kropewnicki teaches a temperature of about 15°C to about 20°C. While the examiner believes this temperature is recited in reference to the substrate temperature, Kropewnicki is not explicit on this point.

Jeng teaches a method of ashing photoresist that overlies a low-k dielectric layer. Jeng teaches that damage to polymeric low-k dielectric materials, such as those used by Kropewnicki, can be eliminated by maintaining the temperature of the substrate between -20° C and 20°C during the photoresist ashing process.

It would have been obvious to one skilled in the art to maintain a substrate temperature of 20°C or less while carrying out the method of Kropewnicki because Kropewnicki is directed to a process of ashing photoresist in the presence of low-k dielectric materials and Jeng teaches that damage to the dielectric material can be eliminated by maintaining a low substrate temperature. Even if the skilled artisan does not presume that Kropewnicki's teaching of a 15°C-20°C temperature is directed to the substrate temperature, the skilled artisan would, nevertheless, be motivated to use the low substrate temperature of Jeng because Jeng teaches that this eliminates damage to the low-k material, which in turn eliminates the prospect of bringing about deleterious changes in the value of the dielectric constant.

Regarding claim 15, Kropewnicki does not teach the formation of a protective film on the surface of the insulating film. However, like Applicant, Kropewnicki teaches using a silicon-containing organic polymer as the low k insulating film. Applicant's specification (page 10) attributes the formation of protection film to the migration of silicon to the surface to react with the reactive oxygen species generated from the plasma. Kropewnicki does not discuss this aspect of the claimed invention; nevertheless, because Kropewnicki's process and the claimed process are the same, the claimed protective film is considered to be an inherent feature of Kropewnicki.

Response to Arguments

Applicant's arguments filed December 19, 2005 have been fully considered and they are not persuasive with respect to Kropewnicki.

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Applicant argues:

"Kropewnicki fails to disclose a ratio W_s/W_b set so that the change rate of the dielectric constant before and after ashing is 10% or less. Thus, the claimed subject matter is not disclosed by Kropewnicki."

The examiner acknowledges that Kropewnicki does not disclose this claimed subject matter. However, the examiner maintains that this is obvious.

With regard to the W_s/W_b ratio, the examiner notes that Kropewnicki teaches W_s and W_b values that provide for a W_s/W_b value as low as 0.2. For a specific example, note the 2400 W source power (col. 10, ln 41) coupled with the application of up to 500 W of bias power (col. 11, ln 25) which provides a ratio of 4.8:1.

Regarding the change in the dielectric constant, the examiner reasoned: it would be obvious to conduct Kropewnicki's process in such a manner that the change in the dielectric constant was 10% or less because permitting the dielectric constant to change by 10% or more would yield a dielectric material with a dielectric constant exceeding the maximum value taught by Kropewnicki.

Applicant argues:

"Kropewnicki only indicates a preferred dielectric constant of a dielectric material, and it does not indicate the change rate of the dielectric constant before and after ashing. Kropewnicki has no motivation to achieve the claimed subject matter since he has no suggestion on the change in dielectric constant before and after ashing."

"Jeng also fails to teach or suggest that the ratio W_s/W_b is set so that the change rate of the dielectric constant before and after ashing is 10% or less"

"Therefore, the claimed invention is not obvious in view of Jeng or Kropewnicki, either alone or in alleged combination."

In reply, the examiner acknowledges that the dielectric constant of 3.0 is disclosed by Kropewnicki as the more preferred value. On the other hand, a dielectric constant of 3.2 is the highest value disclosed by Kropewnicki. Nevertheless, these values are taught by Kropewnicki and the examiner maintains that a skilled artisan would be motivated to conduct the process in a manner that would not cause the dielectric constant to fall outside the range disclosed by Kropewnicki. Again, it is noted that Kropewnicki discloses W_s and W_b values that satisfy the claimed W_s/W_b ratio.

With regard to Jeng, the examiner notes that Jeng was not relied upon in connection to the W_s/W_b limitation or the change in dielectric constant. However, it is noted that Jeng does indeed disclose a process that is specifically designed to minimize damage to a low-k dielectric material.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

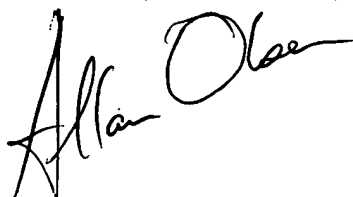
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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M-F 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read "Allan Olsen", is written over a horizontal line.

Allan Olsen
Primary Examiner
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